routing plans to node in the neighborhood of said control node that corresponds to said subject-node re-routing plan.

Q5

46. The network of claim 44 where said control node, when a failure is detected, directs nodes in its neighborhood to execute re-routing in accord with a re-routing plan previously transmitted to said nodes.

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REMARKS

Claims 1-4, 17, 19-21, and 24-34 were rejected under 35 USC 103 as being unpatentable over Galand et al, US Patent 6,038,212 (henceforth "Galand"), in view of Croslin et al US Patent 5,832,196 (henceforth "Croslin"). Applicants respectfully traverse.

The Examiner asserts that at columns 5 and 6 Galand teaches "a method and a system for optimally managing and rerouting of established network connection in case of network link/trunk failure." Columns 5 and 6 essentially cover the "Summary of the Invention" section, wherein it is taught that each node in a network (the network having access nodes and intermediate nodes) stores an image of the current operating network information. When a network error is detected, the method notes the total number of connections that are affected, broadcasts that number throughout the network, and each affected access node is given a random number, a delay is computed based on the given random number, and each access node starts a reconnection setup operation after waiting a period of time that is equal to the computed delay (see col. 5, lines 60-63).

The Examiner goes on to assert that FIG. 1 of Galand teaches in FIG. 1 and columns 6-11 a Trunk Connection Management (TCM) that is "similar to a process module" that calculates the optimum routes through the network," and a Network Topology Database (NTD) that "uses a control spanning tree system for establishing and maintaining a routing tree among the network nodes." "If a failure were to occur, a control message would be dispatched via spanning tree towards access noted similarly to command nodes to trigger rerouting," the Examiner asserts.

Galand does describe a network with eight network nodes (101-108). In FIG. 1 it appears that nodes 102, 103, and 105 are access nodes. Each node includes a Routing Point 200, and a routing point includes a router controller 205, which performs the TCM operation.

The TCM received call setup messages. It manages the bandwidth of each trunk involved in the path specified by a call setup message (col. 8, lines 43-45). Controller 205 facilitates the establishment and maintenance of the connections (col. 8, lies 52 – col. 9, line 8). When a failure is detected, a message is sent to the access nodes (col. 10, lines 4-6). At col. 10, line 9, it is stated "Each entry node, i.e., its Connection Agent, knowing its own connections disrupted by the above mentioned link failure between nodes (108) and (104) shall have to reroute its connections." It bears noting that this is the first mention of a "Connection Agent," and applicants have found no indication (in the text or in the drawing) as to what element of a node constitutes the "Connection Agent." Since the only element that is described in a node is the Routing Point 200, and since the only element within Routing Point 200 that might possibly serve that function is Route Controller 205, applicants reluctantly assume that controller 205 is both the TCM and the Connection Agent.

What that means is that controller 205 performs call setup operations, maintains the set-up connections, and, when a rerouting control message is received (together with a random number), it computes a delay time based on that random number, waits a time period corresponding to the computed delay, and then proceeds to re-perform the connection setup operations while taking account of the failure in the network.

The Croslin reference is applied because, as the Examiner puts it, "Galand fails to include a backup command node," and, according to the Examiner, Croslin teaches a dynamic restoration process that employes an operation support network (OSN) to insure connectivity to the network elements from where the centralized processing system receives failure alarms.

Actually, the OSN is merely a backup network for the communication of alarms from the network elements to the central processing system (CPS).

Applicants respectfully submit that the teachings of Galand and Croslin cannot be combined. The former is a distributed failure-detection and rerouting arrangement, while

the latter is a centralized failure-detection and rerouting arrangement. They are the antithesis of each other. Further, Croslin does not teach a processing module that is a backup control node. The OSN is neither a processing module, nor is it a control node. It simply provides a backup for the communication from the DNEs to the CPS, should the primary link to the CPS (e.g., link 206) fail – see col. 4, lines 32-34. Further still, neither the OSN nor the CPS are a node within the network.

In contradistinction, claim 1 specifies that **each** *node of the network* has a processing module and each processing module is either

> a control node (for links connected to the node), where a control node is a node that triggers rerouting in response to a failure indication associated with said link bundle,

or

> a backup node, where a backup node is a node that triggers rerouting in response to a failure indication associated with said link bundle when said control node is unresponsive.

Assuming arguendo that the TCM of Galand meets the "control node" limitation, it is quite clear that nothing in Croslin satisfies the "backup node" limitation of the claims. As indicated above, the backup notions of Croslin

- are centralized and not distributed,
- they are not embodied in a node,
- they are not embodied in a processing module (but in the OSN packet network),
- they do not address failures in link bundles (that interconnect network nodes) but, rather, failures in links that connect the network to the centralized CPS, and
- the backup functionality does not take effect when "said control node is unresponsive."

In short, in addition to the fact that there is no motivation to combine the Galand and Croslin references because they are diametrically different in concept, Croslin adds nothing that would suggest the notion of a processing module within each node of a network being either a control node or a backup node.

The Examiner has made no explicit comments about claims 2-4, or 17. It is noted that claims 2-4 specify a re-broadcast capability in each node of the network. No such

capability is taught either in Galand or in Croslin and, therefore, it is respectfully submitted that claims 2-4 are not obvious in light of the cited references.

Claim 17 is an independent claim that defines an improved apparatus (node) that includes a processing module which:

> determines, with respect to each of said ports [of the defined apparatus], whether said apparatus is a control node that triggers rerouting in response to a failure indication associated with said ports, or is a backup node that triggers rerouting in response to a failure indication associated with said ports only when another apparatus is unresponsive. (parenthetical expression supplied)

It is noted that the quoted clauses was amended, but the amendment was strictly for the purpose of correcting an antecedence problem. With reference to this quoted language, applicants note that the network nodes of Galand, as well as the nodes of Croslin, do not teach the concepts of "control node" and "backup node." The nodes of Galand do not have a processor that makes the determinations specified in claim 17, and the nodes in Croslin also do not have such a processor (and the Examiner has not asserted that they do). Accordingly, it is believed that amended claim 17 is not obvious in light of the Galand and Croslin references.

In connection with claims 19-21, which depend on amended claim 17, the Examiner asserts that Galand teaches that failures are detected by a node, and that with the aid of the network image that is in the Topology Database the failures can be identified together with all ports whose traffic is disturbed by the failures. Galand also notes the number of connections that are affected by the trunk failure and broadcast the number N. While applicants agree that, indeed, in col. 5, lines 48, Galand states: "broadcasting said N number throughout the network..." applicants respectfully disagree with the Examiner's ultimate conclusion.

Aside from the fact that claims 19-21 are dependent on claim 17 and, as demonstrated above, amended claim 17 is not abvious in view of the cited combination of references, applicants note that, whereas in Galand a node receives a number that is broadcast by the node that detects a fault, claim 19 defines apparatus that receives information about status change. A number is not information about status change. More importantly, claim 19 specifies that the information that is **received** is broadcasted to the other ports of the network. In short, applicants respectfully submit that there is a

patentable difference between a node broadcasting a number that is generated by a node, and a node re-broadcasting received formation; and there is also a patentable difference between a node receiving a number, and a node receiving status change information. The same rationale applies to claims 20 and 21 (and, additionally, claim 20 specifies that the broadcasting is to a *computable* set of ports) and, therefore, applicants believe that claims 19-21 are not obvious in view of the Galand and Croslin combination of references. It is noted, by the way, that claim 20 is amended herein to missing word that was omitted through a typographical error.

Claims 24 and 25 depend on claim 19, which depends on amended claim 17. If only because of this reason, applicants believe that claims 24 and 25 are not obvious in view of the cited combination of references. In connection with claim 25, in particular, applicants wish to add that unlike the Galand arrangement, which deals merely with re-routing existing connections, claim 25 deals with a pre-planning of re-routing. That is, the planning is for some future re-routing, which pre-planning is based on the altered status change information. This is an important distinction. Whereas Galand re-computes the paths that might be used in the presence of a network fault, and executes on the re-computed connections, the instant claim addresses how to re-route in the future, should another fault occur, based on the fact that the network is already burdened with a currently discovered fault, or based on the fact that the network is now relieved of a fault that was corrected. It is further noted that the pre-planning is not necessarily done automatically in response to a received status change information but, rather, "when said communication module deems it advisable to account for said status change information." In other words, the apparatus exercises some "intelligence" in determining what course of action to take (do pre-planning, or do not do pre-planning).

The Examiner admits that Galand fails to teach this notion, but asserts that Crosling discloses (in columns 2, 3, and 4) that the centralized processing system implements a route restoral for all nodes that are impacted by a failure, in that appropriate reroute commands are issued to communication modules within the nodes. The Examiner further asserts that it would be obvious to "modify the teachings of Galand to include communication modules as taught by Croslin in order to identify isolated failed path." Respectfully, that is not material. Claims 24 and 25 specify a particularly

constructed apparatus: one that includes a processing module that, in addition to other attributes that are not described by either Galand or Croslin, "acts in response to [said] status change information" and (in connection with claim 25) the action is a decision, in response to received status change information, whether to pre-plan for a re-routing or not to pre-plan for a re-routing, and to actually pre-plan a rerouting if that is the reached decision. The notion of identifying isolated failed paths -- which is what the Examiner is addressing -- is simply not at issue in connection with the limitations introduced by claims 24 and 25. Applicants believe, therefore, that claims 24 and 25 are not obvious in view of the Galand and Croslin combination of references.

As for claim 26, it depends on claim 25 that, as demonstrated above, is not obvious in view of the cited references. Additionally, claim 26 specifies that the processing module generates a <u>set of re-routing plans</u> for those failures for which the apparatus is a control node. The Examiner asserts that Galand teaches that a node generates a re-routing plan. Applicants respectfully disagree. What Galand teaches is that an access node generates a modifies set of call setups; not a set of re-routing plans. It is believed that the most that can be said is that Galand generates a rerouted set of connections. It cannot be said that Galand creates a re-routing <u>plan</u>. Thus, there are two differences that render claim 26 patentable: the first is that a set of re-routing plans is generated, and the second is that the generated re-routing plan is generated with regard to whether the node is a control node or a backup node – which node must necessarily ascertain in the course of deciding whether to generate a set of re-routing plans or not.

Claim 27 is dependent on claim 26, further specifying that each of the generated re-routing plans in the set of the generated set of re-routing plans is generated for a specifically addressed <u>other</u> apparatus. This is contrary to Galand, where each access node develops a routing only for its respective connections. Applicants respectfully submit, therefore, that claims 26 and 27 are not obvious in view of the Galand and Croslin combination of references.

Referring to claims 29-34, it is noted that claims 29 is an independent method claim. The Examiner asserts that Galand teaches that once a path is selected, the entry nodes sends a call set up message to each node in the path, and that the call set up message within each node is processed by the TCM. The Link Metric Update process

updates the modified link metrics, and the information is sent through the Control Spanning Tree to all of the network nodes. The Examiner states that Galand fails to explicitly disclose the process of re-routing plans, and the process of transmitting to the involved node information for executing the re-route plan, but asserts that Crosling teaches that if a network failure is to occur the DNE (node) ports of the impacted trunk will generate an alarm message. The Examiner's sentence at page 5 in the Detailed Action, lines 7-9, which states "In addition, ports on nodes C, D, M, O, R, and possible other than support the trunk on impacted segment will also generate message alarm and generate a new route circumvention the outage to restore traffic" is not understood, but it is assumed that the Examiner meant that the alarm message causes the creation of a new route that circumvents the outage. While it is true that a new route is created (by the CPS), and that other nodes will also generate an alarm message, applicants fail to see how the generation of new routes by Croslin *in a centralized system*, and the transmission by the centralized CPS of routing information to the various nodes is relevant to the de-*centralized Galand system* where each access node determines connection for its own calls, and engages in no transmission of routing information.

More importantly, it is not clear why the Examiner is focusing on transmission of routing information, when claim 29 specifies a method that includes a step of receiving a message that includes information regarding number of node hops through which said message arrived at said network node. There is no notion anywhere in either Galand or in Croslin that concerns itself with the number of hops in a path. Consequently, it is not surprising that neither Galand nor Croslin describe or suggest any step of

> when said information denotes that said number of hops is less that a preselected number, broadcasting said message to other nodes.

Applicants respectfully submit, therefore, that neither claim 29 nor claims 30-34, which depend on claim 29, are obvious in view of the cited references.

Further, in connection with these dependent claims, applicants also note that the claims address re-routing <u>plans</u> which, as discussed above, is different from the actual computation of how to reroute existing calls, which Galand addresses.

Claim 18 is rejected under 35 USC 103 as being unpatentable over Galand in view of Croslin, and further in view of Arslan et al, US Patent 5,706,276 (henceforth "Arslan"). Applicants respectfully traverse. Claim 18 is dependent on claim 17, and the

limitations that make claim 17 not obvious are not supplied by the Arslan reference. Therefore, it is respectfully submitted that claim 18 is not obvious in view of the Galand, Croslin and Arslan combination of references.

Claims 5, 6, 7, 10, 15, and 16 were rejected under 35 USC 103 as being unpatentable over Galand in view of Commerford et al, US Patent 6,134,671 (henceforth "Commerford"). Applicants respectfully traverse. Claim 5 is amended to make it clearer and not in an effort to overcome a prior art rejection, as is demonstrated in the remarks that follow.

First, applicants respectfully submit that the rejected claims are not obvious because of the reasons set forth above in connection with the Galand reference.

Second, applicants respectfully submit that there are no teachings in Commerford that relate to the additional limitations introduced in the rejected claims. The Examiner asserts that Commerford teaches a plurality of neighborhoods but in support of this assertion all that the Examiner can point to is a fragment of a single sentence. This single, solitary, fragment is found in the sentence "A key aspect of the DRG 25 is the ability to perform restoration for multiple outages 402, and to perform restoration cooperation with another restoration system" (emphasis supplied). A cynical person might say that it can't be much of a "key aspect" if all it deserves is a fragment of a sentence. To put it more seriously, this fragment is ambiguous and, therefore, cannot be said to teach much. There is no indication as to what that "another" restoration system might be, and there is no teaching whatsoever as to the nature of the "cooperation" with that other restoration system. However, in light of the fact that the Commerford reference advises having **backup** restoration systems, as stated in col. 3, lines 28 et seq., it is highly likely that the sentence fragment referred to by the Examiner refers to this backup. That would clearly be something other than a subdivision of a network into neighborhoods. Applicants respectfully submit that to say "it is understood that other restoration systems may include other neighborhoods" is simply a case of a hindsight assertion aimed at later-invented subject matter, said assertion attributing to a phrase a teaching that is simply not there.

Third, applicants submit that since the Galand arrangement has each of its access nodes receive information about a failure, and since each of its access nodes creates its

own rerouting at least for the connections that are affected by the failure, a suggestion to partition the network into neighborhoods makes no sense, and provides no benefit.

Applicants respectfully submit, therefore, that amended claim 5, as well as claims 6, 7, 15, and 16, which depend on claim 5, are not obvious in view of Galand and Commerford combination of references.

Claims 8, 9, 11-14, 22, 23, and 28 were indicated to be allowable, but for the fact that they depend on a rejected claims. It is respectfully submitted that, in light of the above amendments and remarks, these claims are allowable.

Indeed, in light of the above amendments and remarks, applicants believe that all of the Examiner's rejections have been overcome. Reconsideration and allowance of claims 1-34, as well as newly added claims 35-46, are respectfully solicited.

Respectfully,
Mei Deng
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Z Ma

Dated: 11/5/02

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Appendix – Marked Up Version Showing Changes Made

IN THE SPECIFICATION:

Please replace the paragraph beginning at page 2, line 27 with:

An advance in the art is achieved with an arrangement that employs the notion [of] that a failure at any point in the network can be quickly remedied by rerouting traffic at the failed point though network elements in close topological proximity to the failed point. This is accomplished by algorithmically and distributively assigning the responsibility for recovery from all failures to different network nodes. In one illustrative embodiment, each failure is assigned to one primary command node, and to a secondary, backup, command node.

IN THE CLAIMS:

1. A communication network that includes nodes and link bundles that interconnect said nodes, where said link bundles are carried over physical spans of transmission facilities, the improvement in each of said nodes comprising:

a processing module that determines, with respect to each link bundle to which the node of said processing module is connected, whether said node of said processing module is

> a control node, where a control node is a node that triggers rerouting in response to a failure indication associated with said link bundle, or
> is a backup node, where a backup node is a node that triggers rerouting in response to a failure indication associated with said link bundle when said control node is unresponsive.

2. The network of claim **1** where each of said nodes further comprises a communication module that receives status information from nodes connected to said each of said nodes and rebroadcasts said status information to nodes connected to said each node.

3. The network of claim **1** where each of said nodes further comprises a communication module that is adapted to receive status information from all nodes connected to said each of said nodes, and rebroadcasts said status information to said all nodes, except to the node connected to said each of said nodes from which said status information is received.

4. The network of claim 1 where each of said nodes further comprises a communication module that receives status information from nodes connected to said each of said nodes and rebroadcasts said status information to a computable set of nodes connected to said each node.

5. (Amended) A communication network that includes nodes N_p, p=1, 2, 3..., and link bundles L_{pq}, q=1, 2, 3..., that interconnect nodes p and q, where said link bundles are carried over physical spans of transmission facilities, the improvement comprising:

a neighborhood M_p associated with each node N_p, where neighborhood M_p [is] may be different in size from neighborhood M_q [for all $p \neq q$]; and

node N_p comprises a processing module that receives information about spare capacity in neighborhood M_p and maintains a set of re-route plans or pointers to such plans.

6. The network of claim **5** wherein said re-route plans of node N_p involve re-routing of paths between a node N_j in neighborhood M_p and a node N_k in neighborhood M_p.

7. The network of claim **5** wherein said processing module in node N_p initiates a re-route plans creation process whenever it receives information about a change in resource availability in neighborhood M_p that leads said processing module to conclude the a recreation of re-route plans is in order.

8. The network of claim **7** wherein said information indicates an increase in spare capacity, or a decrease in spare capacity.

9. The network of claim **7** wherein said information indicates a decrease in spare capacity because of a failure in an element within its neighborhood.

10. The network of claim **5** wherein said processing module, upon receiving information of a failure condition of a type for which node N_p is a control node for purposes of re-routing, triggers execution of a pre-planned re-routing plan to bypass said failure condition.

11. The network of claim **5** wherein said processing module, upon receiving information of a failure condition of a type for which node N_p is a backup node for purposes of re-routing, triggers execution of a pre-planned re-routing plan to bypass said failure condition when, in response to a query of a node N_q that is a control node for said failure condition, node N_p determines that node N_q will not trigger said execution of said pre-planned re-routing plan.

12. The network of claim **11** wherein said triggering comprises transmitting a re-route plan to each node in neighborhood M_p that is involved in a re-routing to bypass said failure condition.

13. The network of claim **11** wherein said triggering comprises transmitting a pointer for triggering execution of a re-route plan.

14. The network of claim **11** wherein said triggering comprises broadcasting a pointer for triggering execution of a re-route plan.

15. The network of claim **5** wherein said node N_p transmits each of the re-route plans that is developed as part of the re-route plans creation process to nodes in its neighborhood that are involved in said each of said re-route plans.

16. The network of claim **15** wherein a plan ID pointer is included in each of the transmitted re-route plans.

17. (Amended) Apparatus including a plurality of ports, a cross-connect element coupled to said ports, and a control elements for effecting a path through said cross-connect element from a first port of said plurality of ports to a second port of said plurality of ports, the improvement comprising:

a processing module that determines, with respect to each of said ports, whether said apparatus is a control node that triggers rerouting in response to a failure indication associated with said ports, or is a backup node that triggers rerouting in response to a failure indication associated with said ports only when another apparatus is unresponsive.

18. The apparatus of claim **17** wherein said processing module is also designed to receive status information that includes spare capacity information from other apparatus that is connected to said apparatus via said ports.

19. The apparatus of claim **17** wherein said processing module is designed to receive status change information from other apparatus that is connected to said apparatus via said ports, and broadcasts the received status change information to said ports.

20. (Amended) The apparatus of claim **19** wherein said processing module broadcasts said status change information received via a first port to a computable set of said ports of said apparatus.

21. The apparatus of claim **19** wherein said processing module broadcasts said status change information received via a first port to all other of said ports of said apparatus, other than to said first port.

22. The apparatus of claim **19** wherein said processing module receives status change information with a rebroadcast index, and rebroadcasts said status change information following an incrementing of said rebroadcast index.

23. The apparatus of claim **19** wherein said communication module receives status change information with a rebroadcast index, and rebroadcasts said status change information, with said rebroadcast index incremented, but only if said rebroadcast index is less than a preselected value.

24. The apparatus of claim **19** where said communication module also acts in response to said status change information.

25. The apparatus of claim **24** where said communication module acts in response to said status change information by initiating a re-routing pre-planning process when said communication module deems it advisable to account for said status change information.

26. The apparatus of claim **25** where said processing module generates a set of re-routing plans for those failures for which said apparatus is a control node.

27. The apparatus of claim **26** wherein said processing module transmits each of the re-routing plans that it generates to specifically addressed other apparatus.

28. The apparatus of claim **26** wherein said processing module transmits the set of re-routing plans that it generates for a given failure to at least an apparatus that is designated at the backup apparatus for said given failure.

29. A method carried out at a network node comprising the steps of:

receiving a message indicative of a change in resources at another node, said message including information regarding number of node hops through which said message arrived at said network node;

when said information denotes that said number of hops is less that a preselected number, broadcasting said message to other nodes.

30. The method of claim **29** further comprising the steps of

determining whether said message calls for a recreation of re-routing plans, and

initiating a process for creating re-routing plans when said step of determining indicates it advisable.

31. The method of claim **30** further comprising a step of transmitting said re-routing plans, upon their completion in said process for creating, to nodes that are involved in execution of said re-routing plans.

32. The method of claim **31** further comprising the step of directing said nodes that are involved in execution of a particular one of said re-routing plans when said network node detects a failure that calls for said particular one of said re-routing plans to be put into effect.

33. The method of claim **30** further comprising a step of transmitting each of said re-routing plans, upon completion in said process for creating, to respective backup nodes of said re-routing plans, while also keeping said re-routing plans in local storage.

34. The method of claim **33** further comprising a step, responsive to said network node receiving information of a particular failure, of transmitting a re-route plan responsive to said particular failure, to nodes that are involved in execution of the transmitted re-route plan.

Please add the following claims: --

35. A communication network that includes nodes and link bundles that interconnect said nodes, where said link bundles are carried over physical spans of transmission facilities, the improvement in each of said nodes comprising:

a processing module that determines, with respect to each link bundle to which the node of said processing module is connected, whether said node of said processing module is adapted to be either

a control node, where a control node is a node that triggers rerouting in response to a failure indication associated with said link bundle, or is a backup node, where a backup node is a node that triggers rerouting in response to a failure indication associated with said link bundle when said control node is unresponsive.

36. A communication network under control of a single entity that includes nodes and link bundles that interconnect said nodes, where said link bundles are carried over physical spans of transmission facilities, the improvement comprising:

said node being constructed to impart a partitioning of said network into a plurality of neighborhoods, with means in said nodes that allow traffic at a failed point in the network, which point is also at a given neighborhood, to be rerouted solely my changes in paths within said given neighborhood.

37. The network of claim 36 where said neighborhoods partially overlap each other.

38. The network of claim 36 where responsibility for recovering from failures at points of said network is assigned to different nodes of said network.

39. The network of claim 36 where responsibility for recovering from failures at points of said network is distributed to different nodes of said network.

40. The network of claim 36 where responsibility for each of a set of failure points of said network is assigned, for recovery purposes, to a one node of said network as a control node, and to a different node of said network as a backup node.

41. The network of claim 40 where each node that is a control node is adapted to direct nodes in its neighborhood to reroute traffic in case of a detected failure.

42. The network of claim 40 where each node that is a backup node is adapted to direct nodes that are in the neighborhood of its associated control node to reroute traffic in case of a detected failure, and a condition wherein its associated control node is unable to reroute traffic.

43. The network of claim 36, where a control node that is responsible for each neighborhood creates a re-routing plan for failures that might occur is its neighborhood.

44. The network of claim 43 where said control node directs nodes in its neighborhood to re-route traffic, in accord with a re-routing plan previously created by said control node, when a failure is detected.

45. The network of claim 43 where said re-routing plan comprises a set of subject-node re-routing plans and control node transmit each of said subject-node re-routing plans to node in the neighborhood of said control node that corresponds to said subject-node re-routing plan.

46. The network of claim 44 where said control node, when a failure is detected, directs nodes in its neighborhood to execute re-routing in accord with a re-routing plan previously transmitted to said nodes.

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